DOCUMENT RESUME

ED 170 808 CS 502 505

AUTHOR Hopper, Robert; Tilghman, Peter P.
TITLE Visual Context and Children's Sentence Comprehension: Three Studies.
PUB DATE May 79
NOTE 25p.; Paper presented at the Annual Meeting of the International Communication Association (Philadelphia, Pennsylvania, May 1-5, 1979)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Age Differences; *Comprehension Development; Cues; Early Childhood Education; Elementary Education; *Language Development; Language Research; *Listening Comprehension; *Pictorial Stimuli; Sentences; Stimulus Behavior

ABSTRACT

Three studies tested the ability of children of different ages to comprehend spoken sentences while viewing pictures that differed from the sentences according to some plausible combinations of actor, action, and beneficiary. In the first two studies, involving a total of 140 subjects, nine contextual conditions were used, including sentence only, helpful context, and confusing context with between one and four changes from sentence to picture. Analysis of the results indicated that three-year-old children performed poorly in sentence comprehension tasks unless a helpful picture was shown, that five-year-old children were able to respond to verbal stimuli in the absence of helpful visual stimuli but shared the visual reliance of younger children when confusing pictures were present, and that seven-year-old children were 60% to 80% accurate and nine-year-old children 90% accurate, in disregarding confusing pictures and giving sentence-based answers. In the third study, in which 120 children were permitted to choose which type of information (pictorial or spoken) to use in answering questions, three-year-old children demonstrated a clear reliance on pictorial stimuli, which was only slightly diminished for five-year-old children; but seven-year-old children shifted to a fifty-fifty reliance upon sentence stimuli and pictures. (GT)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ED170804

Visual Context and Children's Sentence Comprehension: Three Studies

Robert Hopper and Peter P. Tilghman

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Robert Hopper
Peter P. Tilghman
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Robert Hopper (Ph.D. University of Wisconsin, 1970) is Associate Professor of Speech Communication at the University of Texas, Austin, Texas 78712. Peter P. Tilghman (Ph.D., University of Texas, 1975), is Senior Tutor in Education at Western Australia Institute of Technology, South Bentley, Australia. The authors thank Margaret Sampson, whose M.A. thesis (Sampson, 1973) included Study 1 in this report.

C 550 2 5 2 5

VISUAL CONTEXT AND CHILDREN'S SENTENCE COMPREHENSION:

THREE STUDIES

A great deal of recent research has examined pragmatic aspects of language acquisition. Precise definitions of pragmatics in child language vary, but all definitions emphasize the use of symbols, especially language, in responding to the constraints of socio-communicative situations (Bates, 1976; Lewis & Rosenbaum, 1976; Ervin-Tripp & Mitchell-Kernan, 1977). Among the most noted communication constraints are those which the speaker processes visually (Bloom, 1970; Kraus and Glucksberg, 1969; 1977). The present research examined children's responses to several comprehension tasks involving pictures and sentences. Alterations in the pictures were used to manipulate a number of situational variables, and the researchers examined relationships between these variables and children's sentence comprehension.

The three studies reported here grew out of research (Hopper, 1971) which tested responses to varying difficulties of question forms (Why questions, Yes/no questions, etc.). One portion of that study tested influences upon children's answers of objects held by the tester. For instance, the experimenter asked, "What do you do with a knife?" while holding a knife in his or her hand. A condition in which redundant visual cues accompany a comprehension task is called helpful context because these cues are presumed to aid performance. In the same experiment, the tester also introduced a confusing context condition: for instance, a question such as "What do you do with a knife," might be accompanied by the tester holding a cup in front of the subject. If a subject answered "You drink with it," the response was taken as favoring the visual cue over the sentence. Findings were that four-year-old children evidenced stronger dependence upon visual context, while five-year-olds attended increasingly to sentences.

Hopper and Miller (1972) extended the notion of confusing and helpful visual

contexts in a sentence comprehension study of children aged three to seven years. The tester instructed all Ss to attend to the sentence, and answer questions based upon the sentence even when pictures were in conflict. Stimulis materials included active declarative sentences ("Charlie Brown kisses Lucy."), reversible passive sentences ("Lucy is kissed by Charlie Brown."), and a set of pictures of Peanuts characters performing activities as described. The study included a condition with helpful pictures, a condition with no pictures, and a condition (intended to confuse the subject) which pictured the same actors and action described in the sentence, but reversed the direction of the action. An example of the confusing direction condition is the sentence "Charlie Brown hits Lucy," accompanied by a picture of Lucy hitting Charlie Brown. Subjects were asked questions about the identity of the actors who performed certain acts (e.g. "Who is doing the hitting?") Hopper and Miller found that the helpful context picture boosted comprehension scores compared to the no picture condition. They also found that only an occasional child, even up to age seven, responded in terms of the sentence when shown a confusing direction picture.

The high error rate in confusing direction conditions led to a question whether this condition was particularly deceptive to the child, or whether any picture differing from the sentence stimuli would produce a similarly high error rate. Other possibilities (besides confusing direction) for having a picture differ from a sentence include: the picture could show different actors than those in the sentence, or a different action, or any combination of these.

The three studies reported below represent attempts to understand the relative effects upon sentence comprehension of a number of such visual context manipulations.

Four Aspects of Visual Context

Consider the active declarative sentence:

(1) "Linus kisses Lucy."

In terms of case grammar as interpreted by Brown (1973), and by Chafe (1970), this sentence employs three semantic roles: Agent, action, and patient. Additionally, the action can be considered in terms of (a) its nature, and (b) its direction. The action of sentence 1, for instance could be altered in two ways.

(2a) Linus chases Lucy.

(2b) Lucy kisses Linus

In order to effect (2b) of course, one also exchanges the roles of agent and patient. (More on that later). For now, note that there are four aspects in which a sentence and a picture presented with the sentence may differ: agent, patient, direction of action (hereafter direction) and the nature of the action (hereafter action).

If a picture and sentence are presented simultaneously, the representation of any semantic role in the sentence may be

(a) the same as in the sentence.

(b) changed from in the picture.

(c) absent from the picture.

The distinction between (b) and (c) is best represented by a condition in which no picture is presented. But the absence of action can also be plausibly represented in some conditions by having actors face forward--apparently doing nothing.

This set of possibilities: four semantic roles that may differ from pictures in three ways, could conceivably produce twenty-seven combinations of differences. For reasons already implied, a number of these conditions turn out to be implausible or redundant of each other.[1] We were able, however, to isolate nine

of these conditions that seemed both plausible and separable from each other.

In Table 1, descriptions of these have conditions are arranged from top to bottom, according to the number of dimensions in which sentence and picture

---

Table 1 near here

---

differ. It seemed plausible to predict that the more a picture differs from a sentence, the more it may distract a subject from "correct" answers to comprehension questions based upon the sentences. This line of reasoning assumes that to arrive at a correct response the child must perform mental operations comparing the two, and that these operations become more complicated as the number of picture-sentence differences is increased. This line of reasoning seems similar to that employed in comprehension tasks by Huttenlocher and associates (Huttenlocher, Eisenberg, and Strauss, 1968; Huttenlocher and Weiner, 1971).

This general prediction, however, must be tempered by interpreting Hopper and Miller's results in light of Table 1. In that earlier study, condition 4 (Confusing Direction) proved extremely difficult, although the picture changes only one dimension of the sentence. A probable explanation for this phenomenon is that condition 4 is semantically "tricky," (especially if the sentence takes a reversible passive form) because it appears so similar to the sentence that a subject could be led down a sort of pragmatic garden path, and use the picture as help. In this sense, the confusing direction condition seems analogous to C. Chomsky's (1969) use of a blindfolded doll as a visual stimulus when testing comprehension of the phrase "easy to see."

The general hypothesis guiding these studies, then, is that conditions using misleading pictures to accompany sentence stimuli should cause difficulties in sentence comprehension, generally in direct relationship to the number of differences between sentence and picture. A secondary prediction is that this level of difficulty

interacts with age of the child subject. That is, the difference between the performances in difficult and easy conditions should decrease as age increases.

Agent and Action Questions

Hopper and Miller measured comprehension by asking Ss to identify the agent of an action, for example "Who is doing the kissing?" We reasoned that any semantic role in the sentence (agent, action, or patient could be used as the question target. To see whether differences between such question types affected difficulty of the comprehension, or task, we used both agent and action (What is Linus doing?) questions in Studies 2 and 3. It seemed plausible to predict that questions about the agent would cause greatest difficulties in conditions such as #2 in Table 1 which include sentence-picture difference in the agent. Similarly, such a question by visual context interaction should show low performance conditions such as 3 and 4.

There were other possible kinds of questions that could have been asked, the most obvious of which could have asked subjects to identify the patient of the action. This question (given the types of sentence used) seemed similar to agent questions; hence it was not used. We used the same sort of reasoning in eliminating from the conditions listed in Table 1 a "confusing patient" condition, since a condition varying only this aspect would be unlikely to have much impact except when questions directly concerned the patient. These decisions were less principled then some of our other omissions, and more related to limits on the length of a testing session.

"Correctness" of Responses

All our previous studies (and Studies 1 and 2 here) used the sentence as the basis for deciding what was a "right" answer. However, children are often faced with situations where there are several "right" answers, or where two sets of in-

formation have an equal probability of being "true" or "useful." For example, suppose a child was taken to a baseball game by her parents, and overhead a remark, "That sure was some play." The child knows that her parents went to the theater the evening before, and also knows that there was exceptional baseball play recently completed on the field. The child has to choose between two possible topics. If the parents turn out to be talking about the theater, then the verbal cue does not coincide with the visual cue, the baseball game. If the topic is the baseball game, then the cues do coincide.

If the directions in an experimental test of sentence and visual influences specify a sentence basic for the response, then the child must exclude distracting pictures from consideration to avoid errors. An alternative way to structure the situation would be to instruct the child that he or she may respond according to either the picture or the sentence. In such a condition, less attention would be given to "correctness," and more attention would be given to whether a child chooses to base conversational responses visual or upon linguistic information. This is the sort of data we sought in Study 3.

To summarize: The three studies reported here tested children's sentence comprehension while systematically varying several dimensions of visual context. These variations of visual context were accomplished by showing pictures during the task sessions that differed from the sentence according to some plausible combinations of actor, action and beneficiary.

The methods and results of each study are presented separately in this report after which the findings of all three are discussed. The goals of the studies were:

Study 1: To obtain baseline information about contexts 1-4, and the sentence only condition, both to replicate Hopper and Miller's results, and to test their generality with a different set of materials.

Study 2: To test sentence comprehension in all nine of our plausible contexts,

using both questions about agents and questions about actions.

Study 3: To remove the constraint that only sentence information could be taken as correct, and therefore to see whether children most naturally depend upon visual or linguistic information in formulating responses.

STUDY 1

Method

This research investigated 5 contextual conditions: the three employed by Hopper and Miller, and the two additional contexts in which only one semantic role differentiated sentence from picture.

Subjects were sixty central Texas children, divided in equal sized groups with mean ages four (4;2), seven (7;1) and ten (10;4) years. Sentences in the study included active declarative and reversible passive forms. Pictures were of four imaginary caucasians, two of whom (Mommy and Daddy) were clearly adults, and two of whom (Brother and Sister) were clearly children aged about 5-8 years. Subjects experienced no difficulty in identifying these characters by "name" during warm-up trials. The task in all cases was identifying the agent (e.g., "Who is doing the calling?")

The procedure (followed in all three studies) was that a tester, known to children from his or her previous classroom attendance, took each child individually to a testing room. Both tester and subject sat on the floor. The child was asked to play a game in which a sentence would be spoken as a picture was shown, then the tester would ask a question and the child could respond. In Study 1 and Study 2, the tester cautioned the child that some pictures shown would be tricky, and that the sentence was the key to the right answer.

Next, the tester familiarized the child with the pictured materials and made certain the child could identify them by name without hesitation. Then three

practice trials with simple sentence followed-one with a tricky picture, one with a helpful picture, one with no picture. In Studies 1 and 2, errors in practice trials led to a repeated warning about tricky pictures. Then all stimuli were presented in one session. Sessions were always less than 25 minutes long.

Results and Discussion

A 3 x 2 x 5 analysis of variance revealed significant ($p<.05$) performance differences among the three age groups, the two sentence types (active/passive) and the five context conditions. There were also significant interactions between age and context, and between sentence type and context. These two interactions were examined by means of Fisher's LSD statistic (Li, 1969). Results appear in tables 2 and 3.

Tables 2 and 3 near here

As in previous research, the confusing direction condition produced the most errors. Both Sentence Only and Confusing Agent produced more errors than did Confusing Action. Since all questions were about agents, this last finding supports the prediction that questions about agents are most confusing when the picture-sentence difference involves the agent. A significant ($p<.05$) age by context interaction indicated that, while Confusing Direction was the most difficult condition for all age groups, performance in that context (relative to performance in other contexts) did improve with age. A sentence by context interaction ($p<.05$) demonstrated that confusing conditions could be processed easily in active sentences, but were relatively more difficult under the heavier processing load of the reversible passive. There was also a trend toward an age by sentence interaction ($p<.06$), indicating that older children performed comparatively better on reversible passive sentences than did younger children. In sum, increases in age and task difficulty interacted with difficulty of context.

STUDY 2

This study tested eighty central Texas Children with mean ages 3;2, 5;4, 7;1, 9;5. All sentence stimuli were reversible passives. Nine visual context condition and two kinds of comprehension questions (about agent and about action) were used. All the questions, pictures and sentences used "Peanuts" cartoon characters. All other aspects of procedure repeated those used in Study 1.

Results replicated earlier findings that younger children show more visual dependence than older children. There were few differences between three and five year olds, but seven year olds performed better than younger children, and nine year olds showed near complete mastery of all tasks.

The hypothesis about differences among the nine visual contexts received support. Generally, number of changes between picture and sentence related to task difficulty. A predicted exception was the Confusing Direction condition which changes only one aspect of visual context, but proves as difficult as conditions altering three aspects of visual context (See table 4). The Confusing Direction condition may be so tricky because accepting the picture as the sentence's

---
Table 4 near here
---

eaning creates no obvious anomaly. A second exception was the Sentence Only condition, which proved less difficult than other tasks with 3 or 4 changes between sentence and picture. Apparently, the absence of relevant visual stimuli lacks the distractive consequences of a misleading picture.

An age by context interaction alao emerged (p .05) indicating different orders of difficulty among the nine context for different age groups. Table 4 details this interaction, which shows certain conditions mastered at age 7, and others not mastered until age 9. These results illustrate how the variations of the picture, ranging from complete agreement to one, two, three, or four changes,

can produce increasing difficulty for younger children but not for nine-year olds. Nine-year olds seem no longer to depend primarily upon visual cues, and perform quite well in all contexts. Differences in the frequency of sentence and picture answers among the three confusing contexts should provide information about which context produces more cue dependence at certain ages with certain sentence forms. Predicted interactions between type of question and visual context failed to emerge in the data.

STUDY 3

Method

The purpose of Study 3 was to offer subjects a less constrained choice between visual and spoken stimuli in formulating answers to questions. This goal was approached by telling the child that s/he could answer questions using either pictured or spoken information. We predicted an increased reliance upon verbal information with increase in age.

Offering the child this choice changed the nature of the data. There were few errors, and our interest was which category of information (sentence or picture) the child employed in an answer. Studies 1 and 2 used percentage of correct answers as the dependent variable, but this variable held little interest in Study 3. The variable of interest was categorical and there was no reason to assume equal probabilities of occurrence for the "error" category. Further, the sentence-only condition produced no pictures-appropriate responses, making the usual context conditions difficult to compare with each other.

There is also a methodological problem in combining contexts with questions. Given the method of Study 3, an "Agent question" can occur only in Confusing Agent and Confusing Direction because the question is formed by specifying an action: "Who was doing the kissing?" If the action is the same in both the picture and the sentence, then the child is not directed toward one set of information over

another, Similarly, "action questions" can occur only in Confusing Action because the question specifies an agent.

For similar reasons, conditions which have two or three elements of the picture that are portrayed differently from the sentence had to be excluded from Study 3. For example, Confusing Action and Direction changes both the agent and the action, so either type of question would refer to either the picture of the sentence. These exclusions and reservations created a study of five contexts (the same 5 used in Study 1), two kinds of sentences (active/passive) and two kinds of questions (agent/action). There were two contexts with only one correct answer, and three contexts in which the child could respond with a "picture" answer or a "sentence" answer.

Subjects were 120 children, equally divided into age groups with mean ages 3;6, 4;8, 5;5, and 7;4. Each age group was equally divided by sex, and all children were interviewed in preschools in Vermont of New Hampshire. The testing included six conditions of visual-verbal context: Helpful Picture, Sentence Only, Confusing Agent, Confusing Action, and Confusing Direction. In the Context Helpful condition, all children completed virtually all items correctly, hence this condition will not be mentioned further in this analysis.

In each confusing context, Ss were explicitly offered the opportunity (through directions at the beginning of the interview) to answer with information about the picture or about the sentence. Within each condition, Ss responded to both active declarative sentences and reversible passive sentences. Pictured stimuli were the familiar Peanuts characters. Questions about the agent and questions about the action each appeared in all conditions in which they did not specify a response (see discussion above). Analyses using chi square techniques showed that there were no differences in difficulty between agent and action questions, so results of both kinds of questions are combined in results reported below. However, because of the combining of these diverse responses and because of the

conceptual differences between the Sentence Only condition (having a correct response) and the other three conditions (having two categories of appropriate responses), no statistical analyses are reported for the data in Study 3.

Results

Even without benefit of statistical techniques, a tendency appears in the data toward increasing reliance upon sentence stimuli with increasing age (see Table 5). All visual context conditions demonstrate a clear reliance by three-year olds upon pictured stimuli. The preference for visual over sentence stimuli is only slightly diminished for four and five-year olds. The only difference between these age groups is that five-year olds demonstrate mastery of the Sentence Only condition. By contrast with all the younger groups of children, seven-year olds shift to a fifty-fifty reliance upon sentence stimuli and pictures.

Table 5 near here

Discussion of the Three Studies

The view that emerges from these studies is one of the child beginning communicative development with a primary dependence upon visual cues. This reliance upon visual cues causes three-year olds to perform poorly in sentence comprehension tasks unless a helpful picture aids the task. There appears to be gradual improvement in this respect during the fourth and fifth years, such that a five-year old is able to complete comprehension tasks in the Sentence Only condition. In short, the five-year old can respond to verbal stimuli in the absense of helpful visual stimuli.

The five-year old, however, is still stymied by comprehension tasks which offer competing visual and sentence cues. Faced with the visual-verbal choice, the child generally reverts to a visual processing preference. Study 2 showed

that the child relies increasingly on the picture (i.e., fails to answer correctly) as pictures become increasingly different from sentences. The major exception to this trend concerns the Confusing Direction context, the difficulty of which appears to be tied to the semantic reversibility of the direction difference. To summarize: the five-year old is able to comprehend sentences in the absence of visual stimuli, but shares the visual reliance of younger children when confusing pictures are present.

By the age of seven, the child is able to perform at sixty to eighty percent accuracy in following instructions to disregard confusing pictures and answers on the basis of sentences (Study 2). Perhaps more impressively, study 3 showed the seven-year old freely choosing sentence responses over picture responses half the time when either could be taken as correct.

Finally, the nine-year old shows (in Study 2) ability to disregard confusing pictures and give correct sentence-based answers with ninety percent accuracy. It is interesting to speculate how far the trend toward increasing sentence dependence develops. Do older children or adults ever come to prefer sentences over pictures in confusing contexts, or does the choice remain at the fifty-fifty level shown by seven-year olds in Study 3?

It also seems interesting to speculate whether other situational constraints favor visual or verbal cue dependence. Do school settings favor the verbal over the visual? How does a child interpret situational contingencies to construct relationships between verbal and visual cues? One unique set of responses from Study 3 seems relevant in this regard. A five-year old female repeatedly responded to confusing context conditions by "telling a story" which connected picture to sentence. For instance, when the picture showed Lucy chasing Linus and the sentence was "Lucy kisses Linus," the child responded that "Lucy is chasing Linus to kiss him." This response suggests a situational consistency rule that the child used to define a coherent situation.

Perhaps this response can be interpreted according to Grice's (1975) categories of relation and manner.

One reservation to the findings in these studies is that visual contexts were only represented by pictures. To provide some point of comparison to other methods of presenting visual stimuli we designed a condition in which the testers constructed a Context Helpful condition by acting out the sentence with "Peanuts character" dolls. This procedure was employed (along with a Helpful Picture condition and a Sentence Only condition) in testing thirteen three-year olds and fifteen five-year olds in a suburban Texas pre-school. The tasks were otherwise identical to those used in Studies 1 and 2. Only Agent questions were used. Sentences were active declaratives and reversible passives.

A 2 x 3 analysis of variance showed significant differences between age groups ($p<.01$) and between context conditions ($p<.01$). But the differences among contexts merely distinguished Sentence Only (64 percent correct) from both helpful conditions (80 percent-pictures; 83 percent-action). There were no significant interactions. Our conclusion: Pictured contexts and acted-out visual contexts have similar consequences.

The present research may carry some instructional implications. Reading instruction surely involves combining verbal and visual skills. Reading research supports the notion that use of pictures in early reading materials aids comprehension and retention (Paris and Mahoney, 1974). These three studies, offering a view of visual processes as more primitive in information processing than verbal skills, support such an instructional strategy.

Finally, we speculate that the innovation of allowing both picture or sentence responses in Study 3 led to a marked change in the attitudes of our subjects. Children in all our earlier studies had shown a predictable schoolish lack of enthusiasm for the task. By contrast, subjects in Study 3 remarked that the

task was fun and interesting. Perhaps if instructional strategies concentrated more upon choices from among appropriate alternatives and less upon right answers, children would enjoy education more than they presently do.

TABLE 1
List of Conditions, Showing Picture/Sentence Differences

SAMPLE SENTENCE: Linus kisses Lucy	
Contexts	
No changes from sentence to picture	
1. Context Helpful	Linus kissing Lucy
One change from sentence to picture	
2. Confusing Agent	Snoopy kissing Lucy
3. Confusing Action	Linus chasing Lucy
4. Confusing Direction	Lucy kissing Linus
Two changes from sentence to picture	
5. Confusing Action and Direction	Lucy chasing Linus
6. Confusing Action; Directionless	Linus and Lucy sitting down
Three changes from sentence to picture	
7. Same patient	Snoopy and Lucy sitting down
Four changes from sentence to picture	
8. Irrelevant Picture	Snoopy chasing Charlie Brown
9. Sentence Only	None*

*Omissions from visual context may, of course, have different consequences than substitutions.

TABLE 2

Age by Context Performance: Study 1

Context/Age	% Correct Score 4	7	10	All ages (context main effect)
1. Context Helpful	96^{*}_{a}	95_{a}	96_{a}	96_{m}
2. Confusing Agent	78_{b}	84_{ab}	88_{ab}	83_{n}
3. Confusing Action	92_{a}	86_{ab}	93_{a}	90_{m}
4. Confusing Direction	44_{d}	51_{d}	73_{c}	55_{o}
5. Sentence Only	70_{c}	83_{b}	88_{ab}	81_{n}
All Contexts (age main effect)	75_{x}	80_{xy}	88_{y}	

*percentages with shared subscripts are not significantly different ($p<.05$) from each other.

TABLE 3

Sentence by Context Performance: Study 1

Context/Sentence	% Correct Score Active	Passive
1. Context Helpful	97^{*}_{a}	94_{a}
2. Confusing Agent	90_{a}	76_{bc}
3. Confusing Action	98_{a}	83_{b}
4. Confusing Direction	67_{c}	44_{d}
5. Sentence Only	91_{a}	70_{c}

*Percentages with shared subscripts are not significantly different from each other ($p<.05$).

TABLE 4

Age by Context Interaction In Nine Visual Context Condition: Study 2

Context/Age	3	5	7	9	All ages (context main effect)
1. Context Helpful	63* c	83 b	85 b	100 a	83 x
2. Confusing Agent	50 cd	50 cd	71 bc	79 bc	63 y
3. Confusing Action	54 cd	50 cd	57 cd	91 a	62 y
4. Confusing Direction	45 de	33 e	32 e	91 a	50 q
5. Confusing Action and Direction	18 f	58 cd	85 bc	100 a	65 y
6. Confusion Action/Direction-less	36 e	50 cd	75 bc	79 bc	60 yz
7. Same Patient Only	22 ef	20 ef	42 de	91 a	44 r
8. Irrelevant Picture	27 f	25 f	71 bc	79 bc	50 q
9. Sentence Only	50 cd	20 ef	61 cd	91 a	57 z
All Contexts (age main effect)	40 m	41 m	53 n	92 o	

*All scores represent mean percentage of "correct" responses based upon sentences. Means with common subscripts are not significantly different from each other ($p < .05$).

TABLE 5

Decreasing Reliance on Visual Context with Increasing Age: Study 3

	Ages	3	4	5	7
Visual Contexts					
Sentence Only	Sentence	34*	46	87	97
	Picture (NA)	-	-	-	-
	Error	66	54	13	3
Confusing Agent	Sentence	8	23	17	48
	Picture	82	73	75	48
	Error	10	4	8	4
Confusing Action	Sentence	17	24	39	57
	Picture	73	71	61	42
	Error	10	5	0	1
Confusing Direction	Sentence	18	20	21	43
	Picture	82	80	79	57
	Error	0	0	0	0

*Tabled figures are column percentages within each age-visual context cell.

FOOTNOTE

[1]It may appear that we eliminated some combinations arbitrarily, but some of the circumstances involved were strange or paradoxical. Consider, for example a "same patient only" condition represented in Table 1 by a picture of Snoopy chasing Linus. Since Linus is the original actor and direction is changed, it could also be represented by a picture of Snoopy chasing Lucy since she becomes the actor after the switch of direction. This may be a paradox of the "all Cretins are liars" variety. Either party chosen as actor becomes patient with direction change, violating the constraint to hold the patient constant.

REFERENCES

Bates, E. (1976). Language and context. N.Y.: Academic Press.

Bloom, L. (1970). Language development: Form and function in emerging grammars. Cambridge: MIT Press.

Btown, R. (1973). A first language, the early stages. Cambridge: Harvard Univ. Press.

Chafe, W.L. (1970). Meaning and structure in language. Chicago: Univ. of Chicago Press.

Chomsky, C. (1969). The acquisition of syntax in children from 5 to 10. Cambridge, Mass.: MIT Press, 1969.

Ervin-Tripp, S. and Mitchell-Kernan, C. (1977). Child discourse. N.Y.: Academic Press.

Grice, H.P.. (1975). Logic and conversation. In J. Cole and J. Morgan (eds.) Syntax and semantics, vol. III, speech acts. New York: Academic Press.

Hopper, R. and Miller, L. (1972). Children's dependence upon visual cues in sentence comprehension. Speech Monographs, 39, 140-143.

Huttenlocher, J., Eisenberg, K., and Strauss, S. (1968). Comprehension: Relation between perceived actor and logical subject. Journal of Verbal Learning and Verbal Behavior, 7, 527-530.

Huttenlocher, J. and Weiner, S. (1971). Comprehension of instructions in varying contexts. Cognitive Psychology, 2, 369-385.

Krauss, R.M. and Glucksberg, S. (1969). The development of communication: Competence as a function of age. Child Development, 40, 255-266.

Krauss, R.M. and Glucksberg, S. (1977). Social and nonsocial speech. Scientific American, 236, 100-105.

Li, J. (1969). Statistical inference: Volume I. Ann Arbor, Mich: Edwards Brothers.

Paris, S. and Mahoney, G. (1974). Cognitive integration in children's memory for sentences and pictures. Child Development, 45, 633-642.

Sampson, M. (1973). The influence of visual contexts on children's comprehension of two linguistic formulations. Unpublished M.A. Thesis, University of Texas at Austin.

Veldman, D. (1975). The EDSTAT V users manual. Austin, Texas: Ibid.